

Protoplasm, Past and Present.

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The present day student has become so familiar with the term protoplasm that he has hardly any conception of the important part which this substance has played in the history of biological and philosophical science. It is now about forty years since the doctrine of protoplasm was formulated and thirty-five since Huxley devised the famous phrase, "Protoplasm, the physical basis of life." With the conception of protoplasm was inaugurated modern biology. At that time it was pointed out that the physical basis of all living things is always the same. Wherever there is life there is present a homogeneous jelly like substance, chemically related to albumen. This substance, protoplasm, is indeed the only living substance, all parts of the animal or plants which are not protoplasm having been made by the protoplasm. Such a conception of course greatly simplified the study of living things, since it definitely pointed out the fundamental living substance to be studied.

But the real significance of the new era lay rather in a different direction. The fact was that the doctrine of protoplasm, as advanced by Huxley, gave to the scientist a promise of a speedy manufacture of living matter by artificial means. Protoplasm was described as a chemical compound related to albumen and composed of the same chemical elements, carbon, oxygen, hydrogen and nitrogen. It was said to be a very complex compound indeed, having many hundreds of atoms in its molecule; but nevertheless it was looked upon as a definite compound, or a simple mixture of such compounds. With this conception, life was simply a name given to the peculiar properties of the compound. Hydrogen is a gas with certain properties, and oxygen a second gas with properties of its own. If these two gases are brought together they will unite by chemical affinity and form water (H₂O). Now, water is very different from hydrogen or oxygen. It has definite properties of its own, but no one ever thought of saying that it is endowed with a special force, "aquosity." Albumen is another compound with still more complex properties, but no one thinks of saying that these properties are due to a special force of "albuminity." They are doubtless properties of the compound and explained by the properties of the chemical elements which make up the albumen. So, it was said, when these same elements unite to form the still more complex compound, protoplasm, with even more complex properties, there is no reason for saying it is due to any force of vitality. Vitality, in other words,

it is said, is only a name given to the properties of a certain definite chemical compound.

But the significance of protoplasm was even deeper than this, for it appeared that it should be possible for chemists to manufacture this substance. Chemists have at their disposal the force of chemical affinity, and by using this force they can cause the simple elements, carbon, hydrogen, oxygen and nitrogen, to unite to form simple compounds such as CO₂, H₂O, NH₃, etc. By combining these compounds again they can make more complex ones, and the more they experiment the more complex become the compounds which they succeed in making. By purely chemical means they find themselves beginning to climb a ladder of chemical compounds. At the bottom of the ladder are the simple chemical elements. The various rounds of the ladder are the organic compounds of increasing perplexity, such as alcohol, starch, sugar, etc. The upper rounds are such substances as albumen. Now, the doctrine of protoplasm told the chemists that at the top of this ladder stood protoplasm, itself a chemical compound, greater in perplexity indeed than the others, but still related closely to the rest of the series. Life was one of its properties. Now since the chemist found himself easily climbing this ladder, round by round, he saw nothing in the way of the belief that some day he would reach the top. If he did reach the top, and make protoplasm, he would, in accordance with the doctrine of protoplasm, have succeeded in creating life. As a result of such ideas, it began to be confidently predicted that at no distant day the chemist would climb to the summit of the ladder and thus make a real living thing. This prediction was not an unlikely one, for steadily, year by year, the chemist has continued to climb the ladder of organic compounds. Recently he has actually been able to make some proteids, which are among the very highest in the series, and stand close to protoplasm. The only question in regard to the fulfilment of the prophecy is whether, after mounting to the top, he will find protoplasm in the series. If this substance does stand in the series, then, beyond a doubt, its artificial manufacture would be a possibility and indeed a probability.

All of this has, however, now changed. The chemist is still climbing the ladder, and with ever accelerated speed. His confidence in reaching the top is greater than ever. But the studies of the last fifteen years have shown that he is no more likely to find protoplasm at the top of the ladder than he is to find a steam engine.

So long as protoplasm could be regarded as a definite chemical

compound, the belief in the possibility of its manufacture by chemical means was legitimate enough. But the modern microscope and microscopical methods have shown that the substance is not a chemical compound. It is rather to be looked upon as a very complex machine, with many integral parts, all adapted to each other to act in harmony. The limits of this article do not allow any very extended description of the protoplasmic machine. Such a cell machine consists of many parts. There is a network of fibers, in whose meshes is a watery liquid. Intimately connected with the network are minute granules, which frequently move to and fro. In the middle of the machine is the so-called cell nucleus, which is in itself even more complicated. It is surrounded by a membrane, and contains a network and a liquid, similar to those in the cell body. In addition, it has an extraordinary material called chromatin, which is sometimes in the shape of a network, at other times forms a thread or a tube or a star. There is still another body in the cell, the centrosome, lying in a clear space, the centrosphere. When the cell is in action, this centrosome sends out rods or fibers. These rods seize the bits of chromatin, pull them around into new positions, separating them from each other, and sometimes actually pushing some of them out of the cell for the purpose of getting rid of them. The centrosome acts like an engineer, and seems to be the controlling center of the complex machine.

All of these parts are adjusted to each other and act in harmony, and the life activities are the resultant of the action of the machine. It is true that not all types of living matter are quite as complicated as the one figured, but in all there is found in a similar way a complex machine with part adjusted to part.

It is plain that protoplasm can no longer be looked upon as a chemical compound, the very essence of which is homogeneity. It is equally plain that chemical forces can no longer be looked upon as adequate to produce a bit of living matter. For this purpose would be needed some force which is capable of adapting part to part to form a harmoniously acting machine. The forces demanded for this are mechanical and not chemical, and all attempts to search after a living substance by chemical means are doomed to failure. Not until we can find the forces which can produce the parts of such a machine, and then unite them into a harmoniously acting unit, can we explain mechanically the origin of the simplest living thing.

Whether such forces can ever be discovered, it would be hazardous to conjecture. Considering the minuteness of the machine and its in-

tricacy, it is evident that the problem is a difficult one, and in all probability it lies outside the reach of human ingenuity. We may hope to make chemical compounds ad libitum, but we can not hope to be able to fashion such a machine. Certain it is that the scientist is at present baffled in his search after this ignis fatuus which we call life. Just as he thought he had almost reached it by chemical means, it has slipped from his grasp and he finds that it is not a chemical problem at all. Where to turn his attention now he hardly knows. But science is never satisfied, and we may confidently expect that his probe will in time be turned in a new direction, and who can tell with what successes and what disappointments?—[Popular Science.

Two Views.

The Christian church has for centuries taught that the New Testament was the record of a divine person, who actually came to earth in a miraculous manner, who passed his life in performing miraculous works and who, after the semblance of dying, escaped from earth in a miraculous way. This church teaches that Jesus was not obliged to be born; that he could have escaped birth had he so willed; that he came voluntarily; that it was not the love of his parents which gave to him earthly existence; that it was his own love for the wretched world of man which brought him into life; that he came to fulfil a divine mission and to do a special work.

We hold that the New Testament is a drama and not a history; that Jesus is a fictitious person instead of an actual being; and that for all practical purposes he might just as well have descended to earth from the planet Jupiter as to come in the way that the author of the gospel of Matthew pictures his advent.

We hold that every individual, who has been really born into life on this planet, had nothing to say about his birth, that he had to be born and could not help himself, that he had no choice in the matter, and that all who have lived on this earth came into life with no previous knowledge of the conditions or circumstances of those living here.

It is time to admit that the miraculous Jesus never was born, never lived, never spoke, never did a single act on earth, and it is time to be honest in religious matters. There have been too many falsehoods told for God's sake and too little truth for man's sake.

The teachings of the Christian church about Jesus are not sensible and deserve at the hands of intelligent men only contempt.—[Investigator.